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No. XII.

BANKING FOR CHRONOMETERS.

The SILVER VULCAN MEDAL and TEN GUINEAS were this session presented to Mr. JOHN THOMAS TOWSON, of Devonport, for his Banking for Chronometers. The following communication has been received from him, and a model of his invention is placed in the Society's repository.

SIR, Devonport, April 18, 1826.

I TAKE the liberty to direct your attention to a plan I have invented for banking the chronometer. The nature and advantages of which I have attempted to describe by an explanatory paper, connected with a chronometer, in which the apparatus is adopted, and a model of the bankings. If any other information be required, it will with pleasure be afforded by,

Sir,
Your's, &c.
JOHN THOS. TOWSON.

A. Aikin, Esq.
Secretary, &c. &c.

P.S. As my residence (Devonport) is two hundred and twenty miles from London, and as I have a desire to be in town when the subject is discussed, to answer any inquiries the committee should think fit to make, I should feel myself under the greatest obligation, if it be allowed to come under their consideration as soon as is convenient.

The balances of all moveable time-keepers, the chronometer excepted, are prevented from vibrating beyond the proper arc by what is called bankings. The inferior escapements are very easily banked; a pin fixed in the balance, coming in contact with one or two studs, is sufficient for that purpose. But, as this plan can only be adopted when the vibration is less than 360°, it cannot be applied to the chronometer, the vibration of which generally amounts to 400° or 500°. The duplex escapement has a banking, although its balance sometimes vibrates more than a revolution. This is effected by a piece of steel, having an arm which strikes against a stud, and is so contrived as to shift 180° on the arbor, and consequently does not check the balance when the arm strikes the stud; but the arbor revolves within the shifting piece until the vibration is completed. This plan introduces a very injurious friction into the machine; it is true the shifting piece is light, but the surfaces in contact are very considerable; and composed of the same metal. This friction influences the balance when its momentum is at its minimum, and is very irregular in its operation; the position of the watch, or its motion, and in fact every contingency, serves to vary the degree of friction produced by the banking. Besides these evils, the shifting piece being out of poise, and altering its situation on the arbor, renders it impossible to adjust the balance for position. These evils are not much noticed in the duplex watch, in which the irregularities arising from the variation in position and temperature are considered unimportant; but as these and other evils are counteracted in the chronometer, if similar bankings were introduced into that machine, the errors arising from them would be comparatively very great, and on that account it is not usual to bank the chronometer.

The chronometer not having bankings renders it liable to serious injuries; any circular motion has a tendency to overturn the escapement, and this liability increases in proportion as the centre of motion approaches the centre of the balance. Violent concussions, and pressing the winder the wrong way, have been known to produce the same effect. When the balance overturns, three teeth of the escape-wheel are discharged at one vibration, and the chronometer gains 120″ per minute whilst the balance continues to overturn, which it often does, until some means be adopted to check its motion; and when the balance resumes its usual arc, the chronometer generally loses considerably on its rate. If the balance be suffered to overturn, it obtains a new position from the new form acquired by the balance-spring, and consequently new adjustments are required.

These evils have given rise to various plans for banking the chronometer; but as these methods were imperfect they are laid aside. The first plan adopted to answer this purpose was invented by the late Mr. Brookbanks; it was effected by a bolt thrown out by the balance-spring when unwinding, so as to stop a pin fixed in the balance when the balance vibrated to the right; but this banking suffered the balance to overturn towards the left, and when in action caused an injurious friction of the balance-spring. There are various modifications of this plan; but as these alterations produce no advantage, it would be useless to describe them. The next method was invented by Mr. Arnold; and Mr. Hardy has invented a modification of the same plan. These bankings are fixed to and supported by the balance-spring. Mr. Arnold found the plan injurious, as it rendered the coils liable to touch, and on that account laid it aside many years since. These, as well as the other plan, only banked on one side, and on that account are very imperfect.

The plan to which I take the liberty to direct your attention banks the balance on both sides, operates without friction, does not encumber the balance-spring, nor render it liable to jar; and it will bear the severest trial, some part of the machine giving way before it will cease to produce the desired effect. It is very simple in its construction, and may be made by an ordinary workman. The plan I adopt is to form two planes in front of the stud to which the balance-spring is fixed, and taper the stud to a strong spring. On my balance-arbor I fix a piece of steel, the shape of a fan, having an upright ridge about 80° round the balance; the piece is first turned in a circle, and afterwards shaped with a file; when the balance is at rest, the centre of the ridge stands between the planes on the stud; but if the balance moves 270° either way, one or the other of the planes checks the ridge, and prevents further vibration. The spring-stud is moved by the unequal action of the balance-spring. This is evident from the circumstance, that the spring moves contrary to the balance; if the motion were not produced by accumulating an unequal action of the spring, it would of course move with the balance. Independent, then, of the banking, the effect produced in rendering the spring more equal in its action must be beneficial. Besides this advantage, it decreases pivot friction, for if one end of a spring has a tendency to move right or left, the other end must have a contrary inclination of equal force. Since, then, the one end of a balance-spring has a tendency to move with a force sufficient to bend the strong spring-stud, the other end would, with the same power, force the pivot to the opposite side of the hole, if an ordinary stud were used. But as the spring-stud accommodates the balance-spring, in so doing it must relieve the pivots from a degree of friction equal to the force that the balance-spring exerts on the spring-stud in bending it. To prove whether this theory were correct, when the chronometer was in the rough, I made a piece of steel to pass over the spring, so as to render it stationary, and I found the vibration sensibly less when the stud was fixed, than it was when the spring was allowed to act, which I considered to be the effect of the friction alluded to. The fan piece can be so placed as to poise the balance, by compensating for the piece cut out of the roller.

The evils arising from the balance overturning have almost done away with the use of chronometers for pocket purposes; the motion of the body in both walking and riding, the act of taking it out of the pocket, inattention in winding, or any unsteady motion, is sufficient to render the machine useless. On this account the preference has of late years been given to the detached lever, although an inferior escapement. Compensation balances have been added, and the adjustments attended to. I have finished such watches, and am convinced chronometers might be made with bankings in less time. Chronometers are dearer, because as they are useless for the pocket, they are now manufactured for nautical purposes only, and the trade is consequently confined. Although bankings are by far more requisite in a pocket-watch than in a marine timekeeper, it is of great advantage even in nautical pur-

purposes. Carelessness of those who wind the machine has often caused serious errors. Concussion from firing guns is so likely to produce these injuries, that it has lately been thought requisite to send the chronometer in a boat to some distance before the guns are practised. If the chronometer be not held perfectly steady in the hand whilst winding, the balance overturns. This rule cannot be attended to during a storm. The concussion of guns, and the motion of the ship at that period, increase its liability to overturn. And what adds to the importance of this circumstance is, that it is after such an event that an error is likely to be serious. During fair weather, the dead reckoning would detect a very considerable error; but in a storm the cause cannot be ascertained; the log is of no use, and consequently a rate is taken as soon as an opportunity occurs, and the result confided in, if the performance of the machine be generally good. A confidence in a false reckoning subjects the mariner to considerable inconvenience, and exposes him to imminent dangers.

Reference to the Engraving of Mr. Towson's Banking for a Chronometer.—Plate V.

Fig. 1. *a* the balance-spring stud, rendered elastic by tapering, it is here attached to the underside of the cock, shown only by dotted lines *b b*, but may be on a separate foot, according to the will of the workman; *c d* a plane with a square notch through it, placed on the end of the spring-stud, seen better in fig. 2, which is a front view; *e e* a piece of steel, part of which is a segment, the circumference of which is turned up at right angles. When the balance is at rest, as in figs. 1 and 2, the centre of the upright ridge remains free in the notch *c d*, the elastic stud *a* being a tangent to it; but when the balance vibrates 330° to the right, the balance-spring brings the elastic stud so much nearer to the centre, that the side *d* stops the ridge of the fan, as shown in fig. 3; in like manner, the side *c* stops the balance from vibrating more than 330° to the left, as shown in fig. 4, so that the total vibration is limited to 660°, and by increasing or decreasing the width of the fan *e*, the vibration may be limited to any arc between one and two circles.

Fig. 5 is a side view, the balance and balance-spring, all but its two ends, being in section, to show the ridge of the fan *e*; in the notch of the plane *c d* the balance-spring is pinned to the stud, close by the end *d*.

No. XIII.

DRAG FOR DROWNED BODIES.

The SILVER VULCAN MEDAL and FIVE GUINEAS were presented this session to Mr. S. WILLIAMS, 2, Stone-stairs, Ratcliffe, for a Drag for Drowned Bodies. The following communication has been received from the candidate, and a model of the apparatus has been placed in the Society's repository.

SIR, 2, Stone-stairs, Ratcliffe.

I HAVE sent you a drag for the purpose of raising persons that have sunk under water; the drag, you will see, must